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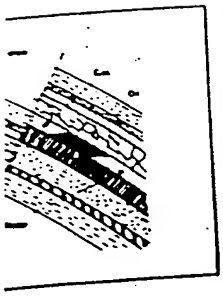

Modern Petroleum

A basic Primer of the Industry

by Bill D. Berger
and Kenneth E. Anderson

PennWell Books
PennWell Publishing Company
1421 S. Sheridan
Tulsa, Oklahoma 74112

ments which keep a permanent record on paper disks or tapes. Each keeps track of the date and time, and then keeps track of a particular bit of information such as hook load, pump pressure, hole depth, rate of penetration, fluid level, etc.[6]

Routine Drilling Ahead

The next step in drilling the well is the actual drilling process, called routine drilling ahead. This is done one joint of drill pipe at a time. When making a connection, (adding a new joint of pipe) the new pipe joint is raised from the storage rack and placed in the mouse hole on one side of the bore. The swivel and kelly are disconnected from the string, swung over and connected to the new joint, which is then raised into position over the bore and connected to the string in place.

Barring difficulties, drilling ahead continues until it is time to change the bit, either because it has become dull or a different type of bit is required. In order to change the bit, the driller must "make a trip." Thus a round trip would include bringing the drill string out of the hole, replacing the bit, and getting the string back into the hole and into operation again. During the process, drilling fluid pressure must be maintained in the hole to prevent any possibility of a blowout.

The manner in which the trip is made will depend on the capabilities of the particular rig. Normally, the drill pipe is pulled out in strands of three joints, called a "thribble." Smaller rigs can only handle a "double" (two joints), while a very large rig with a tall derrick can handle "fourbles" (four joints).

In tripping out, the kelly is drilled down before the drill string is pulled. Then the swivel, kelly, kelly cock, and rotary bushing are placed in the rat hole out of the way. Then the elevators on the hook and block assembly are latched around the pipe just below the tool joint box. The pipe is then pulled and stood on the rig floor until time to return the string.[7]

Deviations

A well that is drilled exactly vertically is called a straight hole. However, there is almost always some deviation from the vertical. The maximum amount of deviation permissable is specified in the drilling contract. There are several causes for the bit to "wander" from the vertical, as there are ways of measuring the amount, and methods of correction.

6. Berger, pp. 51-53 7. Ibid., p. 53

If heavy weight is placed on the bit to maintain a constant rate of penetration and a slanting formation is encountered, the bit may deviate. To counter this, the driller can place a stabilizer above the first collar on the string. This acts as a pivot point and when weight on the bit is reduced, the collar becomes a pendulum and the string tends to naturally swing back to the vertical. If the hole is slanted, but within the limits of the contract, a number of different bottom-hole assemblies can be utilized to keep it as straight as possible.

To determine deviation, the hole is periodically surveyed. One such instrument which can be lowered inside the drill string utilizes a paper disk which is punched by a device much like a bob and plumb line. The angle of drift can then be determined by how far the punched hole is from the center of the disk. Another device, working on the same principle, utilizes a back-lighted disk, followed down by a special camera. The image indicates how far off-center the hole may be.[8]

These same measuring techniques are used when it is necessary to purposely deviate, or to drill in a direction other than straight down. Directional drilling is employed in salt-dome reservoirs and fault plane control; to drill relief wells, along lease lines, or if the pay sands are an inaccessible location.[9]

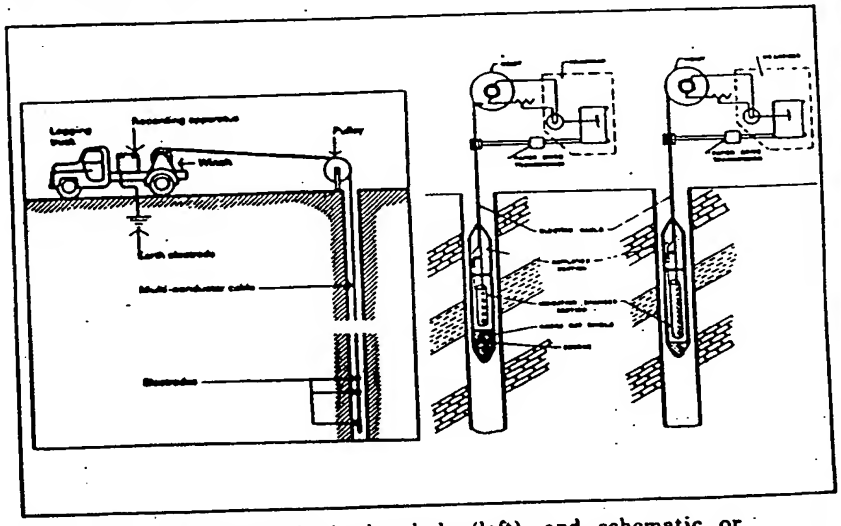

FIG. 4-13 Placing sonde in borehole (left), and schematic or components for radioactive logging. *(Petroleum Extension Service)*

9. Ibid., p. 59 8. Ibid., p. 77